Post Storm Survey

A Partnership to Improve the Communication and Understanding of Winter Storms

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Saint Cloud State University
Saint Cloud, MN

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Duluth, MN

Western Region SAFER Workshop May 17th 2010

The Idea

A Survey

- Feedback - Insight into Decision Making & Understanding
- Not a critique of the forecast accuracy
- Available through variety of web-based outlets
- Not National Weather Service Centered

Roadblocks

- Partnerships outside of NWS
- Paper Reduction Act
- Needed to find a Partner to work with – Student?

From Idea ⟶ to Action

Post Storm Survey

Seeking a Partnership (Fall 2007)

- Sent Letter to SCSU Meteorology Department Faculty
- Advertised at Winter Storm Conference

Received a Very Eger Response

- Matt Taraldsen - Sophomore at SCSU
- Student Volunteer – Summer 2007
- Hometown – Duluth, MN

From Idea → to Action

Motivation

"Need a process by which WFO [Weather Forecast Offices] can systematically gather local customer input and local research results … and turn that information into improved products and services"

Ray Wolf – Science and Operations Officer NWS WFO Davenport, IA

Goal

Improve communication & effectiveness of winter weather information and threat by gaining insight into perceptions and decision making processes related to hazardous winter weather.

From Idea ⟶ to Action

Post Storm Survey

Developed *Plan of Action* *(November 2007)*

- Determine Survey Strategy
  - Online – no budget, convenient data
  - Available for 3 days Following Winter Storms
    - Storms that require a "Warning"
  - Survey Home Page (SCSU) – partners would link to
  - Test Season, Followed by Review

Mike Bettwy, Matt Taraldsen
Amanda Graning, Amy Henry

From Idea ⟶ to Action

Develop Survey Questions

- Tailored after Drobot's
  - Quick Response Survey Results 192 (July 2007) http://www.colorado.edu/hazards/research/qr/qr192/qr192.html
- Input:
  - SCSU Communications & Meteorology Departments
  - NWS Forecasters
  - Media Input
  - Great WAS*IS Feedback

From Idea ⟶ to Action

Post Storm Survey

Drafted a Project Proposal *(December 2008)*

- Approval
  - SCSU Office of Sponsored Programs
  - Sent to NWS Central Region Headquarters
  - Approved and used in Eastern Region (2010)
- Distribute to Partners, Any Interest?
  - Media, State Climate Offices, Universities, other NWS

All set to go!

Deployed Survey *(March/April 2008)*

- Test Season: 3 events, 500 Responses
- 4 partners (2 NWS, MN Climate Office, MN Homeland Security
- More visibility!!

Post Storm Survey

- Winter 2007-2008:
  3 Events (test season), 500 Responses
- Winter 2008-2009:
  12 Events, 2500 Responses
- Winter 2009-2010:
  12 Events, 3100 Responses

27 Winter Storms
>6000 Responses

Project Partners

Survey Publicity

Articles & News Stories

- Over a dozen media interviews!
- Minneapolis Star Tribune

  http://www.startribune.com/local/34968514.html?elr=KArksUUUU
- Minnesota Public Radio Story
- SCSU Alumni Magazine
- NWS Peak Performance Newsletter
- Duluth News Tribune
- Saint Cloud Times

Utilized Facebook and Twitter

- Communicating with partners
- Gain Visibility
- Additional Dissemination

Survey Publicity

Post Storm Survey Presentations

- Community Engagement Workshop *2008 (Taraldsen)*
- Northern Plains Winter Storms Conference *2008*, *2009*, *2010* (Taraldsen, Graning, Henry, Bettwy)
- Northern Plains Winter Storms Conference *2010* (Taraldsen, Graning)
- SCSU Faculty and Students *2009*, *2010* (Taraldsen)
- NWS Diversity Summit *2009* (Graning)
- NWS Duluth Media Day *2008*, *2009*, *2010* (Graning)
- SCSU Student Research Colloquium *2009*, *2010* (Taraldsen)
- Winchell Undergraduate Symposium *2009* (Taraldsen)
- SAFER Workshop!

Developed a Brochure to hand out at workshops
Created Graphic For Media to Show during Weather segment

Matt's Role

Researched Previous Work

- Winter storm communication not widely researched
- Nearly all papers were for summertime warnings

Project Leader

- Multiple SCSU Departments
  - **S**tatistics, Communications, Meteorology & Technology
- Approval

Student Workspace to Create Survey Homepage

- Survey Monkey to house Data
- Analyzed and Distributed Data

Coordinates When to make the Survey Active

- Several Regions, Forecast Areas

The Post Storm Survey Final Results

Matt Taraldsen

Post Storm Survey Events

2008-2009

Dec 12	Blizzard	DLH, FGF
Dec 18	Ice Storm	DMX
Dec 19	Lake Effect Snow	DLH
Dec 20	Blizzard	MPX, ABR, FSD, DMX
Dec 20	Winter Storm	FGF, ARX, DLH, MPX
Dec 30	Winter Storm	FGF, DLH, MPX
Jan 3	Winter Storm	DLH, MPX, FGF
Jan 12	Blizzard	FGF, FSD, DMX
Jan 12	Winter Storm	MPX
Jan 12	Wind Chill	DLH
Feb 8	Ice Storm	DLH
April 5	Blizzard	DMX

2009-2010

Dec 8	Blizzard	ARX, DMX, MPX, OMA, TOP, FSD
Dec 8	Winter Storm	ABR, DLH
Dec 24	Blizzard	DLH, OMA, TOP
Dec 24	Winter Storm	ARX, MPX, FGF, DLH
Dec 25	Blizzard	FGF, FSD, ABR
Jan 7	Winter Storm	MPX
Jan 21	Ice Storm	DMX, FSD**
Jan 25	Winter Storm	DLH, FGF**
Jan 25	Blizzard	DMX, FGF, MPX, FSD, ABR**
Feb 9	Winter Storm	MPX, ARX, DMX, FSD, ABR, FGF
Feb 9	Lake Effect Snow	DLH**
Feb 11	Winter Storm	BGM**

The Survey Questions

1. Where do you get weather information on a regular basis?
2. Where did you get your weather information during the storm?
3. Based on the forecast; what did you feel was the primary weather threat from the storm?
4. Based on the forecast, do you feel that this was a climatology "usual" storm?
5. Based on the forecast, what special preparations did you take for this storm?
6. How did you alter your daily routine during this storm?
7. If you did alter your daily routine, what specifically made you do so?
8. If you did not alter your daily routine, what convinced you alterations were not necessary?

Demographic Information:

Gender, Age, Occupation, Commute Time, Education Level, Trained Weather Spotter

Demographic Information

Post Storm Survey

Age

	2008	2009	2010	Average	2000 Census
<16	2%	1%	1%	1.3%	21.40%
16 - 22	11%	8%	7%	8.7%	13.90%
23-39	29%	38%	38%	35.0%	20.90%
40 - 59	**51%**	**46%**	**46%**	**47.7%**	34.20%
>60	8%	8%	9%	8.3%	9.60%

Occupation

	2008	2009	2010	Average
Retired	6%	6%	8%	6.7%
Student	11%	4%	2%	5.7%
Unemployed	3%	5%	4%	4.0%
Industrial	5%	10%	13%	9.3%
Self-Employed	3%	1%	2%	2.0%
Professional	35%	40%	42%	39.0%
Public Service	9%	9%	8%	8.7%
Teacher	25%	23%	21%	23.0%

Demographic Information

Gender

	2008	2009	2010	Average	2000 Census
Male	**69%**	**68%**	**69%**	**68.7%**	49.10%
Female	31%	32%	31%	31.3%	50.90%

Average Commute

	2008	2009	2010	Average	2000 Census
1 -15 min	**55%**	**52%**	**55%**	**54.0%**	N/A
15 - 30 min	33%	32%	33%	32.7%	N/A
31 - 59 min	10%	14%	10%	11.3%	N/A
60+ min	3%	3%	3%	3.0%	N/A

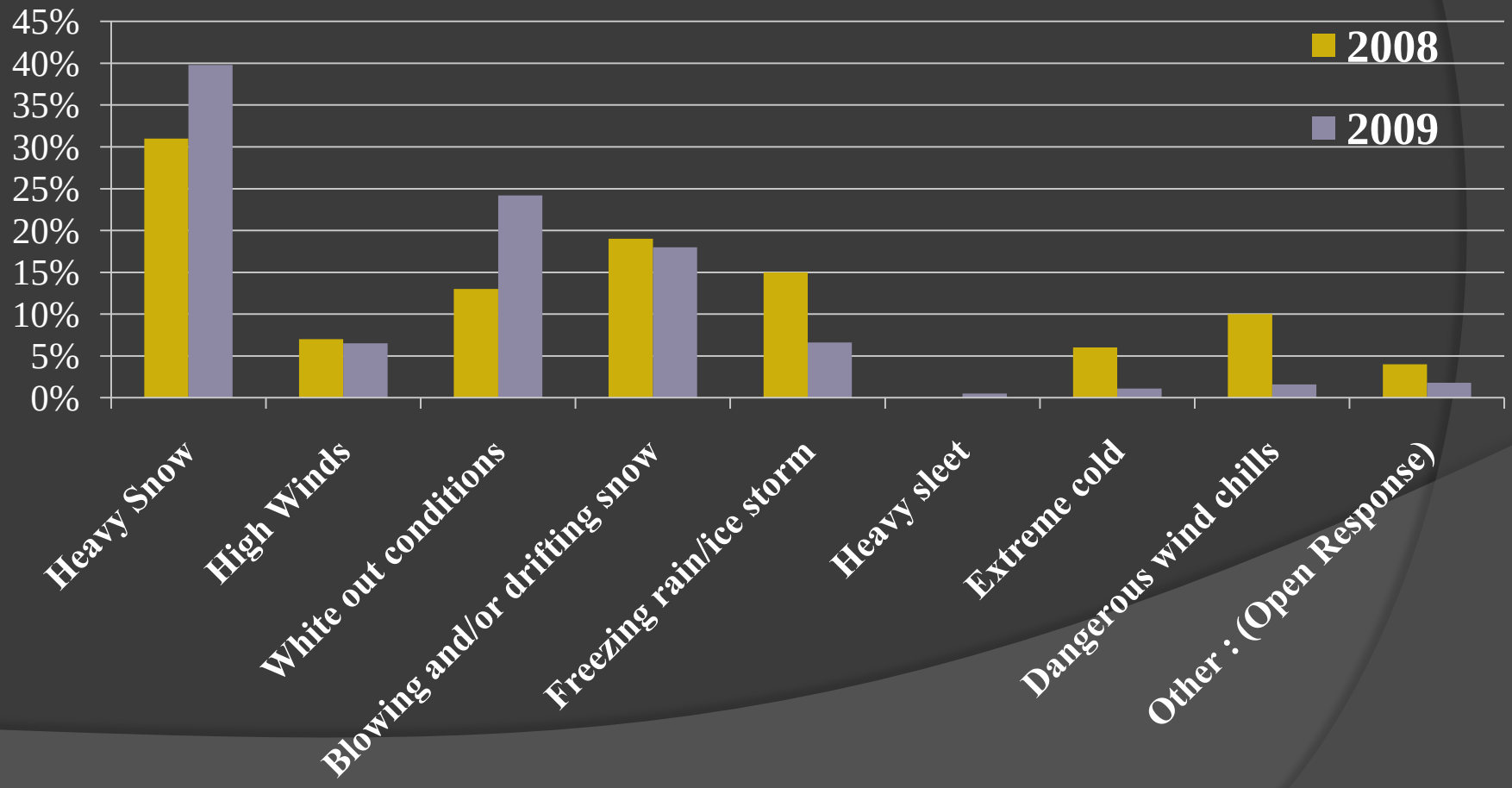
Are you a weather spotter?

	2008	2009	2010	Average	2000 Census
Yes	24%	22%	28%	24.7%	N/A
No	**76%**	**78%**	**72%**	**75.3%**	N/A

Survey Responses

** Combined responses from all events**

3. Based on the forecast, what did you feel was the primary weather threat from the storm?

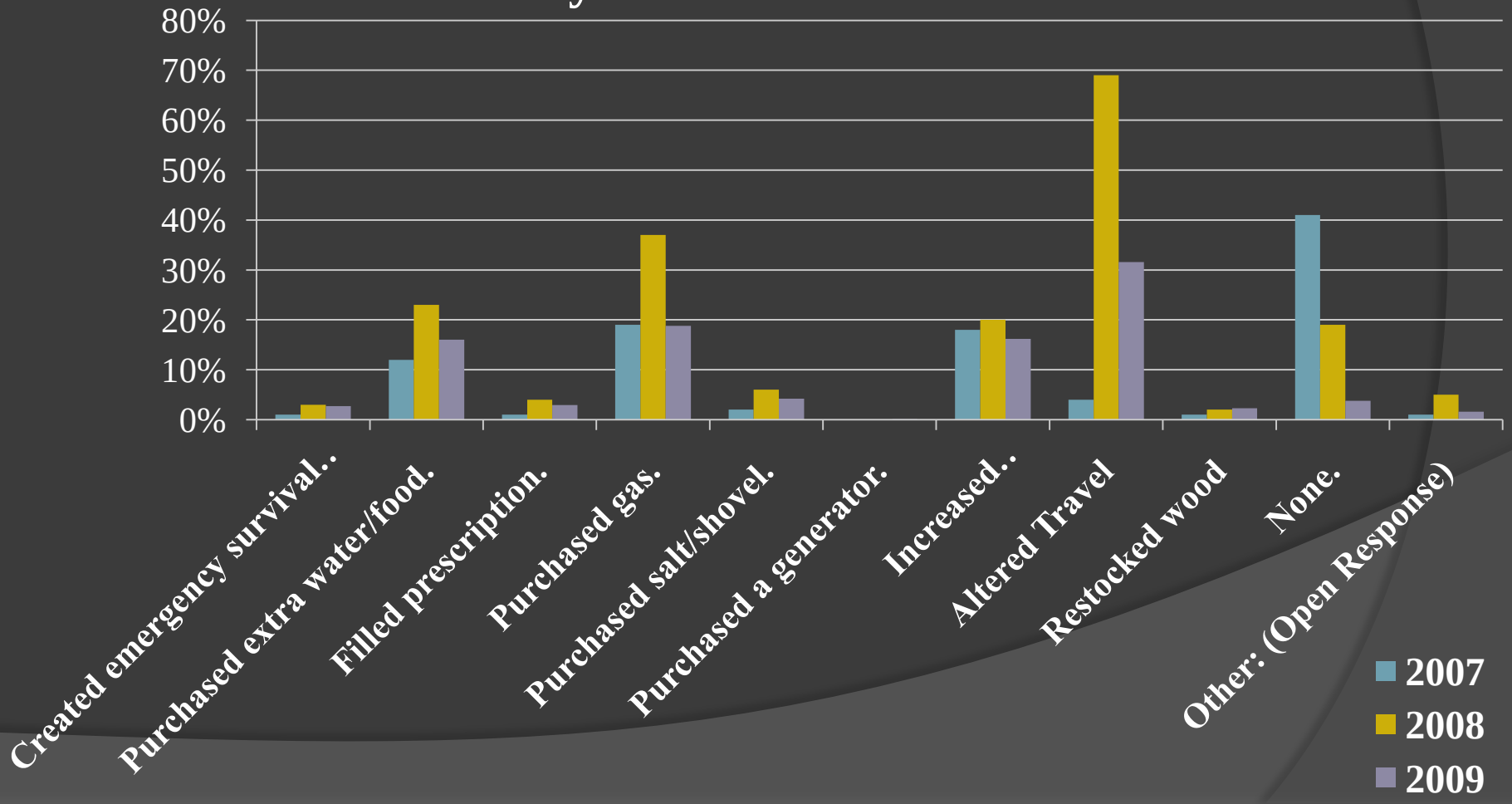


Survey Responses

** Combined responses from all events**

Post Storm Survey

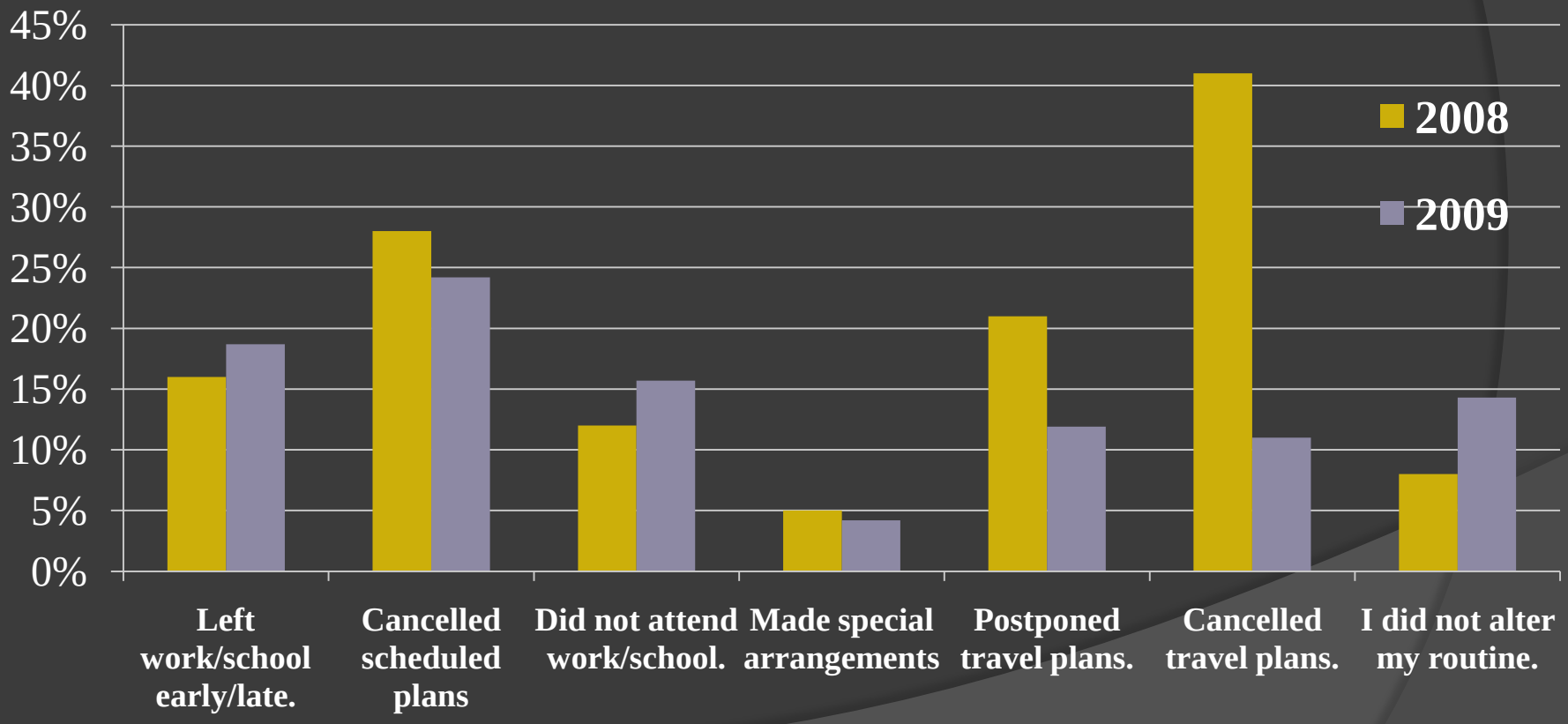
5. Based on the forecast, what special preparations did you take for this storm?



Survey Responses

** Combined responses from all events**

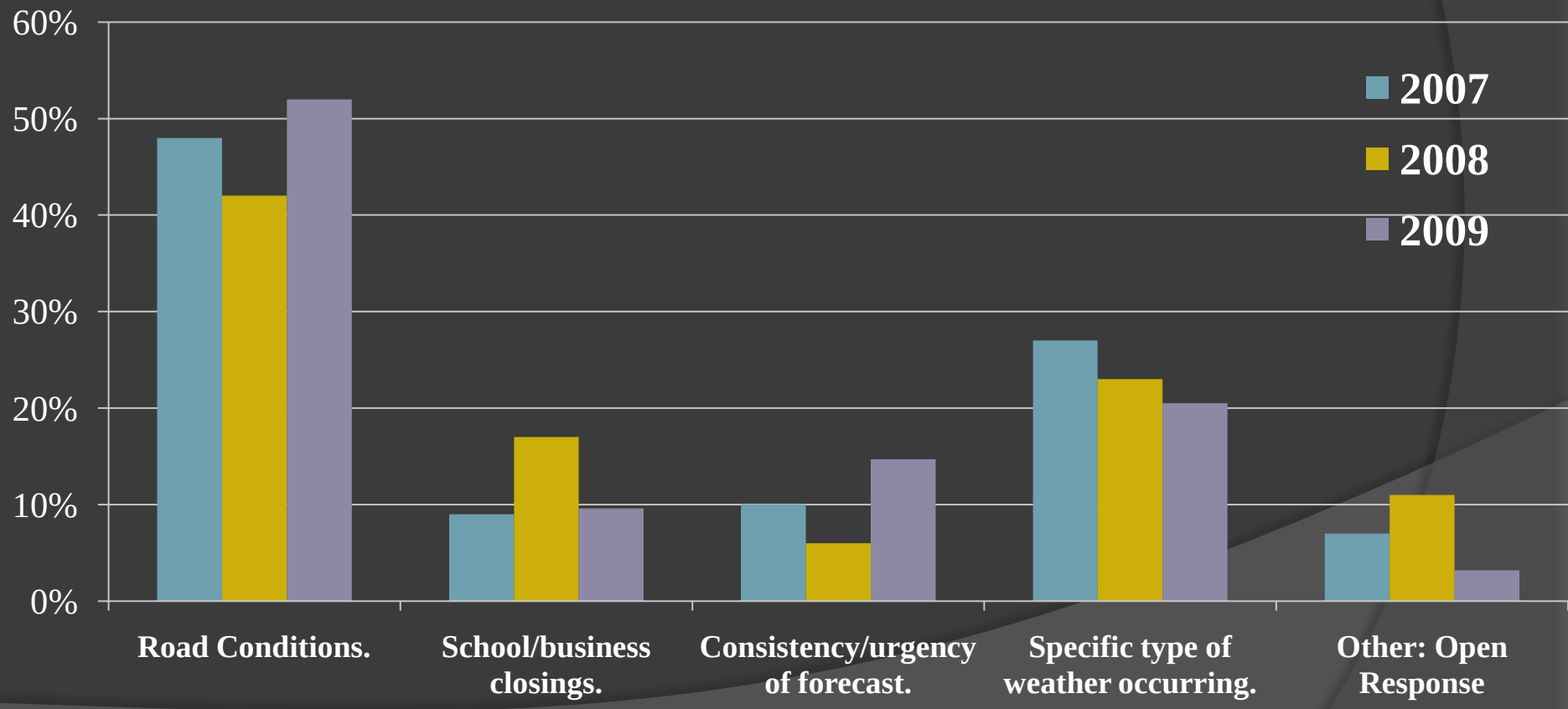
6. How did you alter your daily routine during this storm?



Survey Responses

** Combined responses from all events**

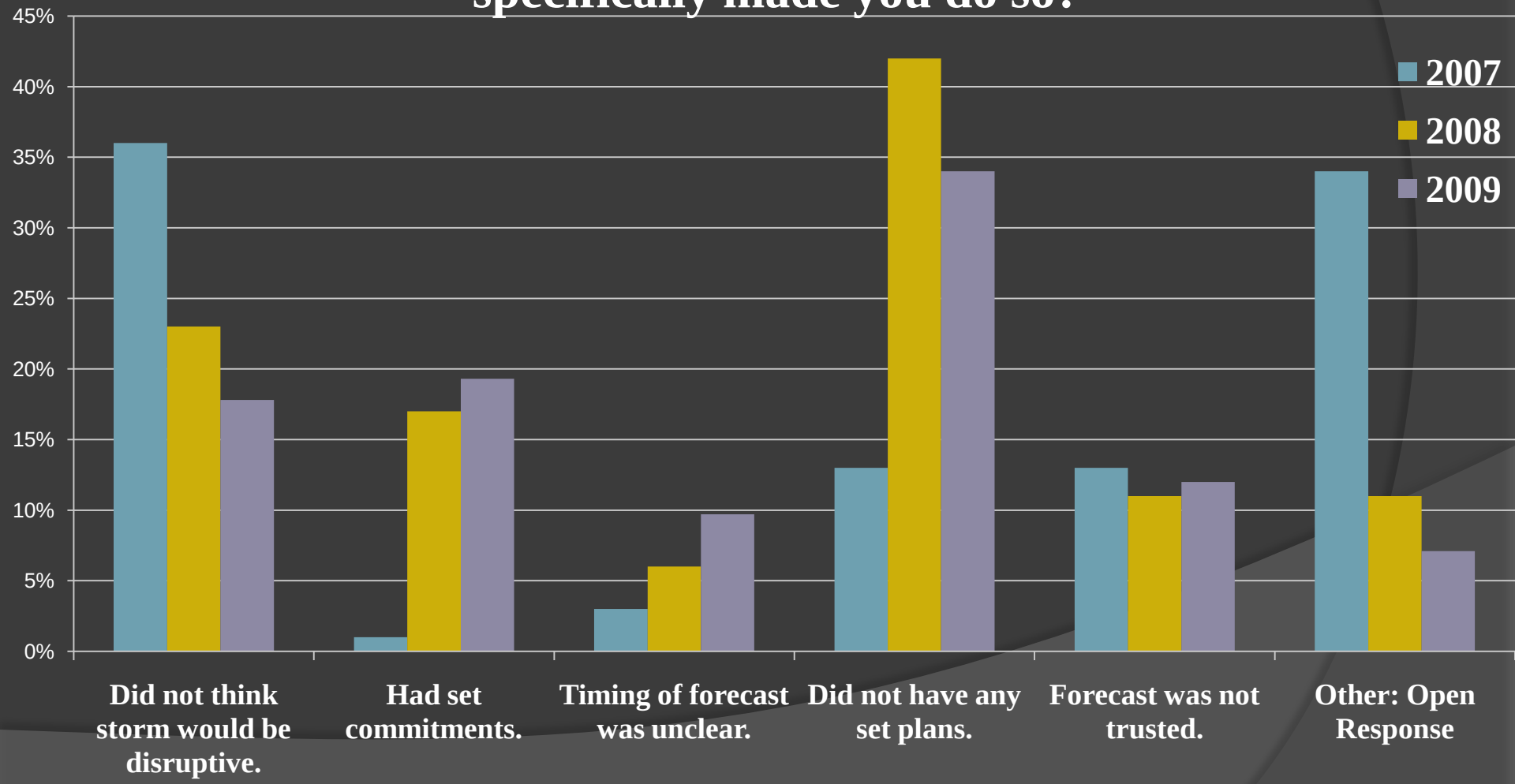
7. If you DID alter your daily routine, what specifically made you do so?



Survey Responses

** Combined responses from all events**

8. If you DID NOT alter your daily routine, what specifically made you do so?



Conclusions

Post Storm Survey

- **Road Conditions!**
- Respondents react to non-meteorological indicators (school closings, road conditions, etc.)
  - Snowfall rates do not link to travel conditions
- Trending forecasts and timing both communicates uncertainty
- People do pay attention to “Warnings”
- The type of warning is poorly understood and prompts minimal reaction

Conclusions Continued

- As event unfolds, media becomes crucial
- Mixed messages from weather community Opens door for confusion and distrust between NWS and Media
- Notable differences in responses between urban/rural locations and various regions of Plains.
- Demographic data depicts smaller details
- Differences in events that were busts and surprises…adds confidence to final results
- Still widespread bias against the meteorologist

The Future

Post Storm Survey

- Matt has Graduated
- New Student project Leader – Sara Stalker
- More Involvement
  - NWS Eastern Region interested
  - Additional Media
  - Additional Universities

Acknowledgements

- Amy Henry
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- Dave Kellenbenz
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- Bill McAuliffe
- Douglas Neville
- Brian Curtice
- Jennifer Zeltwanger
- David Nicosia
- Phil Shumacher
- Dave Nicosia

**** Lots of Great Feedback & Input from Was*Is Email Lists and Contacts ****

Assessing the Threat of Winter Events

NWS Weather Forecasting Office
Duluth, Minnesota

Amanda Graning
Amy Henry
Mike Bettwy
Carol Christensen
Dan Miller
Dean Melde
Peter Parke
Greg Frosig
Tom Lonka
Kevin Donofrio





Interesting perception…

"I live in Northern MN, a snow storm with 25" is not a big deal."

Danger Degree Project

Weather Forecasting Office Duluth, MN

Motivation

There are situations where the physical science can be perfect, but its utility is greatly reduced where there is not adequate attention to the societal aspects

Goal

An effort to create a historical reference for use in assessing the threat of snowfall cases that may or may not fall into the National Weather Service (NWS) defined criteria for winter weather advisories or warnings

Danger Degree Project

Disclaimers

- Caution! Assigning Values to Event
  Not Intended to Categorize Storms (like Hurricanes)
- A Tool for Addition Perspective
- May miss “Big Picture”
- Adapted to other Areas & Hazards

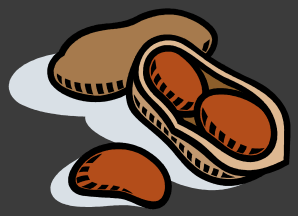
Danger Degree Project

Weather Forecasting Office Duluth, MN

- Developed a "checklist" of factors that are given values
- Values result in a ***Danger Degree*** (threat level) for that event
- Theory: Higher the score, greater the potential Impact

Danger Degree Project

Process in a Nut Shell



- Sub Groups
  - Finalize Checklist
  - Gather Data & Compile Checklists
  - Data Entry
- Checklist for Events 1997-2009
  - 2” Daily Snowfall Criteria
  - Peer Review
- Compared Events by Headline
  - Warning/Advisory/None

Other Checklists

WINTER STORM IMPACT ASSESSMENT

Parameter	Low	Moderate	High	Extreme
[1]Storm Total Snowfall (in).....	< 1-3	3-6	6-12	12+
[2]Snowfall Rate (in/hr).....	< 1	1	> 1-2	2+
[3]Ice accumulation (in).....	≤ T	< ¼	¼ - ½	> ½
[4]Wind (mph, sustained or frequent gusts)	< 15	15-25	25-35	> 35
[5]Visibility (mi).....	3+	½ - 3	¼ - ½	< ¼
[6]Air Temperature (°F).....	33+	28-32	20-27	< 20
[7]Dew Point (°F).....	33+	30-32	25-29	< 25
[8]Ground/Pavement Temperature (°F).....	33+	28-32	19-27	< 19
[9]Time of Day.....	Overnight	Evening	Day	
[9]Day of the Week.....	Weekend	Weekday	Rush Hour	Holiday
[9]Time of the Year.....	Mid-winter	Early/late season		
Total #				

[1]More snow = greater effort for removal

1 More snow = greater effort for removal
2 Higher snowfall rates = rapid accumulation = increased challenge for keeping roads open
3 Ice accumulation = impact on travel, power
4 Wind = impact on blowing and drifting; synergy with ice accum
5 Visibilities = impact on travel including aviation
6 Temperature= impact on melting and wind chill
7 Dew Point = influence on melting
8 Ground/Pavement Temperature = influence on melting
9 Societal impact factors

Other Checklists

Eastern Region Proposal

HIGH-IMPACT GUIDELINES FOR WINTER WEATHER*

Rick Watling
March 3,. 2008

Instructions:

Pick one numerical impact value from each of the 4 categories shown below and enter the numbers into the list below that. Add the numbers together to estimate public impact.

CATEGORY	IMPACT VALUES
Timing	Rush hour/school buses running = 3 Non-rush hour, day and evening = 2 Overnight (10 PM to 6 AM) = 1
Seasonality	First/last storm of season or holiday/election day storm = 3 Mid-season, infrequent storms (≤ 1 / month) = 2 Mid-season, frequent storms (1 or more / month) = 1
Weather Phenomena	Freezing precipitation, black ice = 3 Widespread visibilities below ¼ mile = 3 Extreme Cold (2 SD below normal minimum) = 4 Moderate/heavy intensity sleet, wet snow or mix = 2 Windy (sustained winds > 30 mph or gusts > 45 mph) = 2 Light intensity sleet, snow or mix = 1 None of the above = 1
Post-storm Conditions (12 or more hours)	Windy *and* temperatures ≤ 32F = 3 Windy *or* temperatures ≤ 32F = 2 Temperatures much > 32F with rapid snowmelt = 2 Temperatures slowly moderating above freezing = 1 None of the above = 1

1) TIMING _____
2) SEASONALITY _____
3) PHENOMENA _____
4) POST-STORM CONDITIONS _____

TOTAL SCORE _____

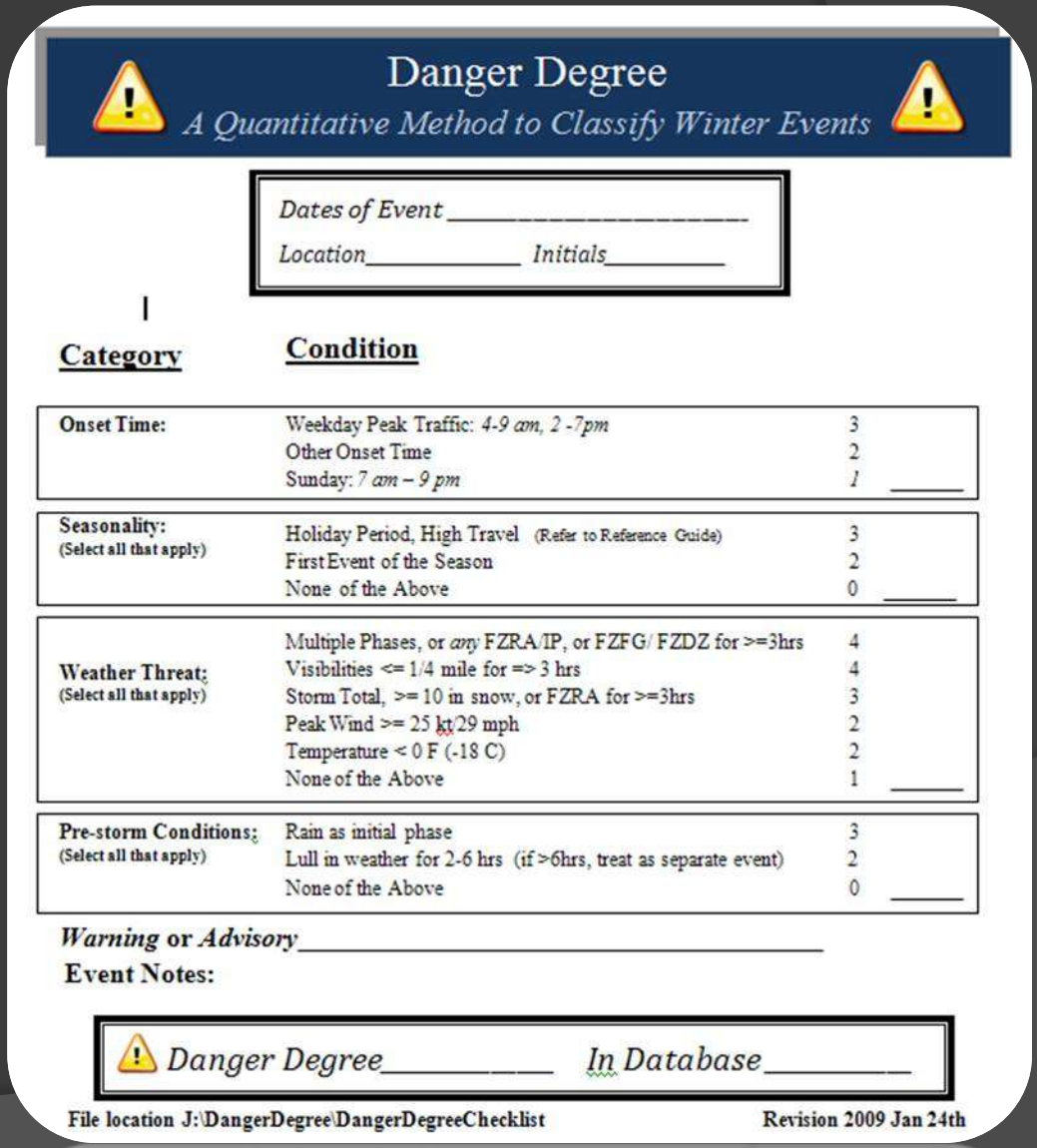
IMPACT BASED ON TOTAL SCORE:

8-12 HIGH
6-7 MODERATE
4-5 LOW

The Checklist

WFO Duluth, MN

- Specific Location
  - Duluth, MN
  - International Falls, MN
- Event Criteria
  - Snowfall of >2”
  - Looked at Daily Climate Report (LCDs)
- Weather & Societal Factors
  - METARs
- Sum Each Section



Danger Degree

A Quantitative Method to Classify Winter Events

Dates of Event _____

Location _____ *Initials* _____

Category	Condition		
Onset Time:	Weekday Peak Traffic: *4-9 am, 2 -7pm*	3	
	Other Onset Time	2	
	Sunday: *7 am – 9 pm*	*1*	_____
Seasonality: (Select all that apply)	Holiday Period, High Travel (Refer to Reference Guide)	3	
	First Event of the Season	2	
	None of the Above	0	_____
Weather Threat: (Select all that apply)	Multiple Phases, or *any* FZRA/IP, or FZFG/ FZDZ for >=3hrs	4	
	Visibilities <= 1/4 mile for => 3 hrs	4	
	Storm Total, >= 10 in snow, or FZRA for >=3hrs	3	
	Peak Wind >= 25 kt/29 mph	2	
	Temperature < 0 F (-18 C)	2	
	None of the Above	1	_____
Pre-storm Conditions: (Select all that apply)	Rain as initial phase	3	
	Lull in weather for 2-6 hrs (if >6hrs, treat as separate event)	2	
	None of the Above	0	_____

Warning* or *Advisory _____

Event Notes:

Danger Degree _____ *In Database* _____

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The Checklist

Onset Time

Category	Condition		
Onset Time:	Weekday Peak Traffic: *4-9 am, 2 -7pm*	3	
	Other Onset Time	2	
	Sunday: *7 am – 9 pm*	*1*	_____

- Maximum Traffic - Rush Hours
- Minimum Traffic – Sunday
- Other

The Checklist

Seasonality

Seasonality: (Select all that apply)	Holiday Period, High Travel (Refer to Reference Guide)	3	
	First Event of the Season	2	
	None of the Above	0	

- High Travel Periods
- First Event of Season
- Everything Else

The Checklist

High Travel Periods

MEA Weekend

- Start Tribune,. Bob Von Sternberg

"At Minneapolis-St. Paul International Airport, this long weekend [MEA] is as busy, or busier, than Thanksgiving"

HS State Tournament Data

- MN State High School League

The Holiday or High Travel days recognized for this project as are follows:
(Holiday/High Travel Period includes one day either side of a Holiday/High Travel Day)

- Minnesota Educators Association (MEA) Weekend.....3rd Weekend in October (Wed -Mon)
- Deer Hunting Opener
  - Minnesota.....2nd Sat (Fri-Sun) in November
  - Wisconsin.....3rd Sat (Fri-Sun) in November
- Thanksgiving.....4th Thurs (Wed-Fri) in November
- Christmas.....24-26th December
- New Years Day.....31st December - 2nd January
- Fishing Opener (Friday – Sunday)
  - Minnesota.....2nd weekend (Fri-Sun) in May: *Mother's Day*
  - Wisconsin.....1st Sat (Fri-Sun) in May
- National Election Day.....1st Tuesday in November/every 4 yrs
  - 2008 November 4th, 2004 November 2nd, 2000 November 7th, 1996 November 5th
- MN State High School Sports Tournaments

Boys Hockey			Boys Basketball	
2009	March 10-15		2009	March 24-29
2008	March 4-9		2008	March 26-30
2007	March 6-11		2007	March 20-25
2006	March 7-12		2006	March 21-26
2005	March 1-6		2005	March 15-20
2004	March 9-14		2004	March 23-28
2003	March 4-9		2003	March 18-23
2002	March 5-10		2002	March 20-24
2001	March 6-11		2001	March 21-25
2000	March 7-12		2000	March 22-26
1999	March 2-7		1999	March 17-21
1998	March 3-8		1998	March 18-22
1997	March 4-9		1997	March 19-23
1996	March 5-10		1996	March 19-24

The Checklist

Weather Factors

Weather Threat: (Select all that apply)	Multiple Phases, or *any* FZRA/IP, or FZFG/ FZDZ for >=3hrs	4
	Visibilities <= 1/4 mile for => 3 hrs	4
	Storm Total, >= 10 in snow, or FZRA for >=3hrs	3
	Peak Wind >= 25 kt/29 mph	2
	Temperature < 0 F (-18 C)	2
	None of the Above	1

- Mixed Precipitation
- Visibility – hazardous travel/aviation
- Storm Total - greater effort for removal/ challenge for keeping roads open
  - >10” Implies heavy snow, high snowfall rates
  - Threatens Power lines
- Freezing Rain sustained for 3 consecutive hours – ice accumulation
- Peak Wind – implies blowing and drifting
- Temperature – black ice/wind chill
- None - had to have 2” of snow to qualify

** Values Representative for Northern Minnesota/Wisconsin **

The Checklist

Awareness

Pre-storm Conditions; (Select all that apply)	Rain as initial phase	3	
	Lull in weather for 2-6 hrs (if >6hrs, treat as separate event)	2	
	None of the Above	0	_____

- Rain initially implies warm period, people caught off guard
- Lull between snowfall periods creates confusion

SN began 400 am

First >2 of winter

Mixed Phases
Snow Total = 3.5”
2.3” in 24 hr period.

Gusts 30-35 kt for 24 hrs

Began: 36 F & Rain

SN ended for 4 hrs - then continued.

Danger Degree

A Quantitative Method to Classify Winter Events

Dates of Event 2006 October 11-13th

Location DLH *Initials* _____

Category	Condition		
Onset Time:	Weekday Peak Traffic: *4-9 am, 2 -7pm*	3	
	Other Onset Time	2	
	Sunday: *7 am – 9 pm*	1	3
Seasonality: (Select all that apply)	Holiday Period, High Travel (Refer to Reference Guide)	3	
	First Event of the Season	2	
	None of the Above	0	2
Weather Threat: (Select all that apply)	Multiple Phases, or *any* FZRA/IP, or FZFG/ FZDZ for >=3hrs	4	
	Visibilities <= 1/4 mile for => 3 hrs	4	
	Storm Total, >= 10 in snow, or FZRA for >=3hrs	3	
	Peak Wind >= 25 kt/29 mph	2	
	Temperature < 0 F (-18 C)	2	
	None of the Above	1	6
Pre-storm Conditions: (Select all that apply)	Rain as initial phase	3	
	Lull in weather for 2-6 hrs (if >6hrs, treat as separate event)	2	
	None of the Above	0	5

Warning or *Advisory* _____

Event Notes:

Danger Degree 14 *In Database* _____

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Danger Degree Project

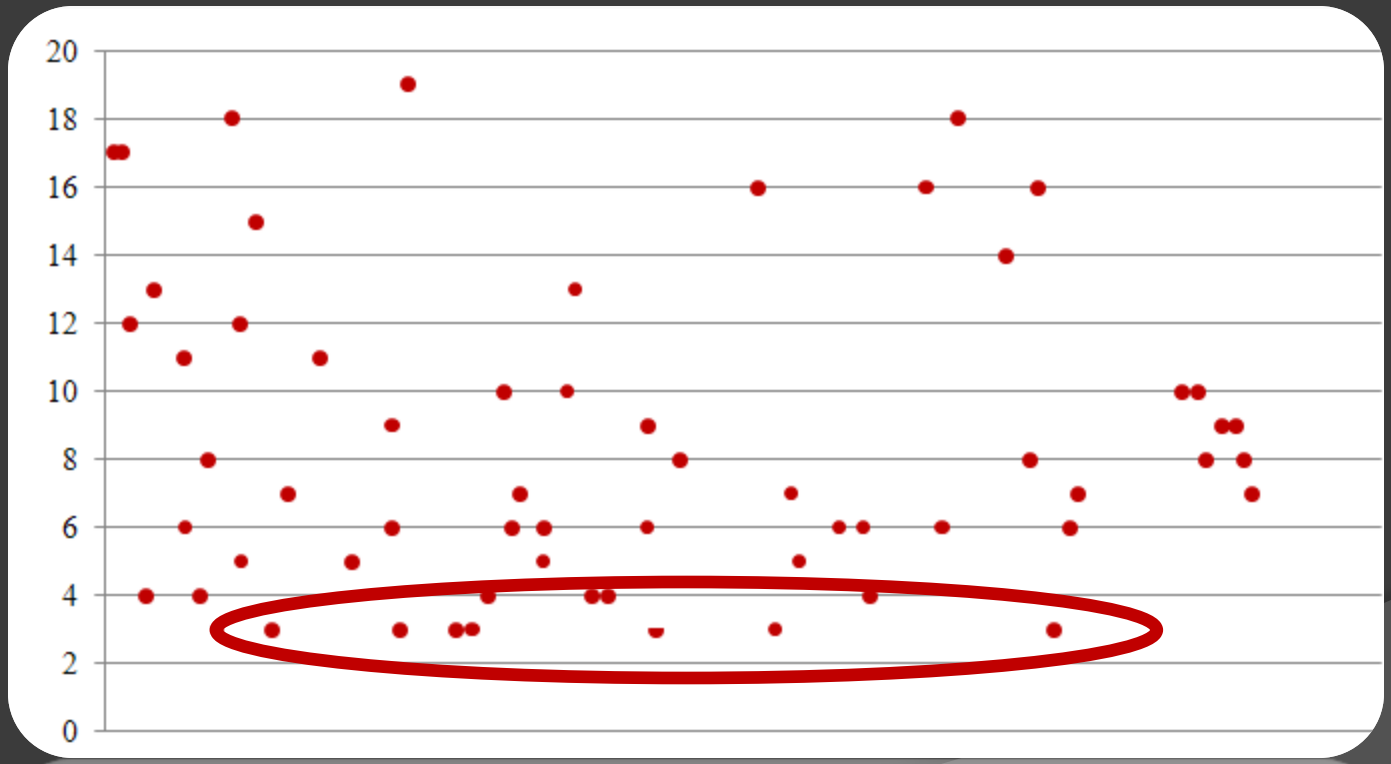
Duluth, MN	International Falls, MN
146 Events	105 Events

- 2009: 4
- 2008: 10
- 2007: 8
- 2006: 18
- 2005: 18
- 2004: 8
- 2003: 6
- 2002: 10
- 2001: 11
- 2000: 9
- 1999: 10
- 1998: 16
- 1997: 11

- 2009: 12
- 2008: 10
- 2007: 8
- 2006: 18
- 2005: 18
- 2004: 8
- 2003: 16
- 2002: 3
- 2001: 11
- 2000: 9
- 1999: 10
- 1998: 9
- 1997: 12

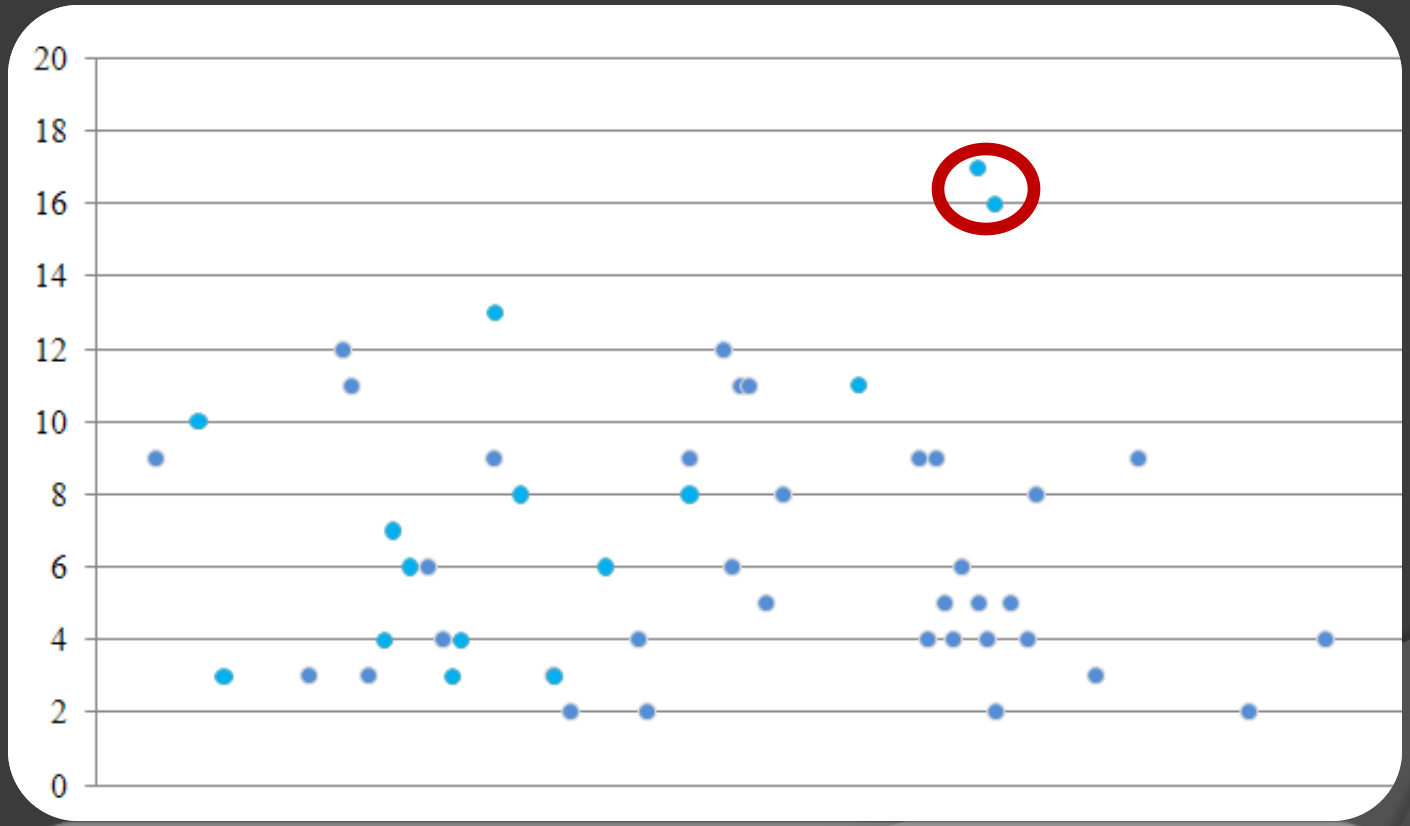
Danger Degree Project

Warning Events



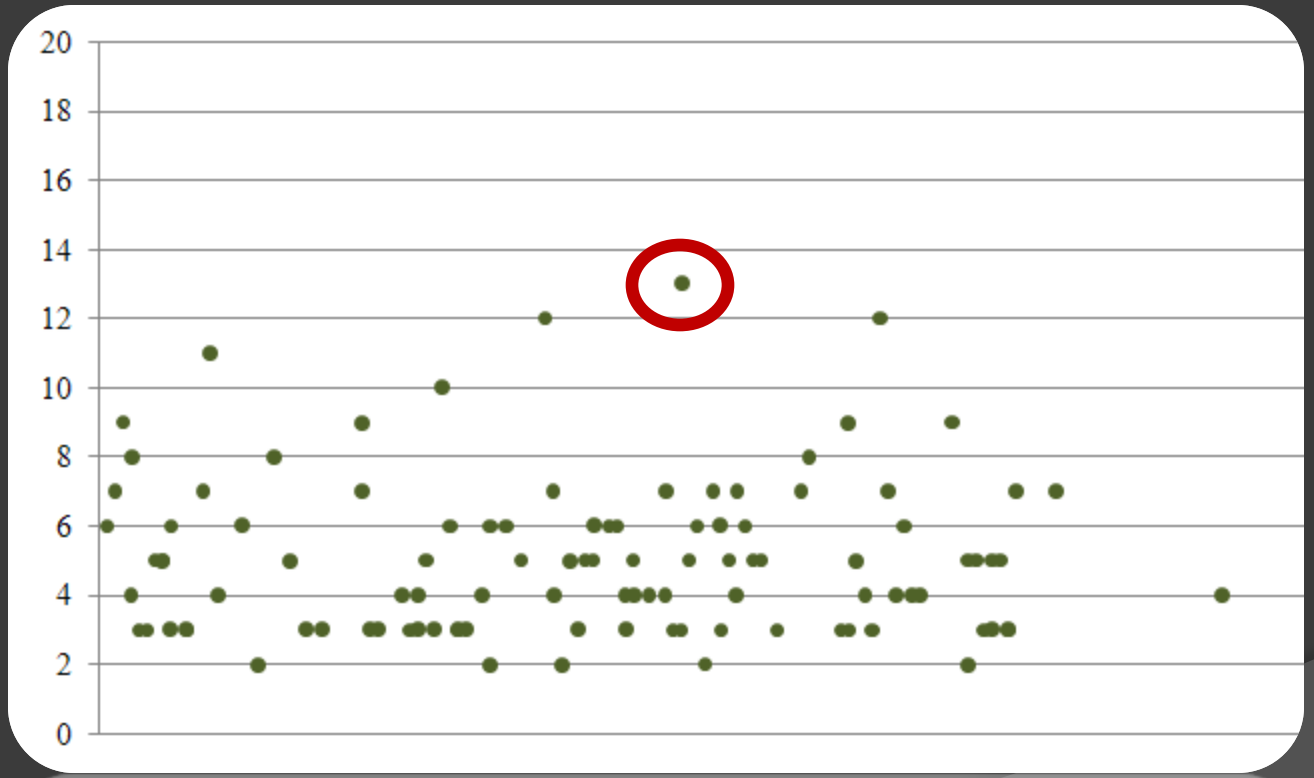
Danger Degree Project

Advisory Events

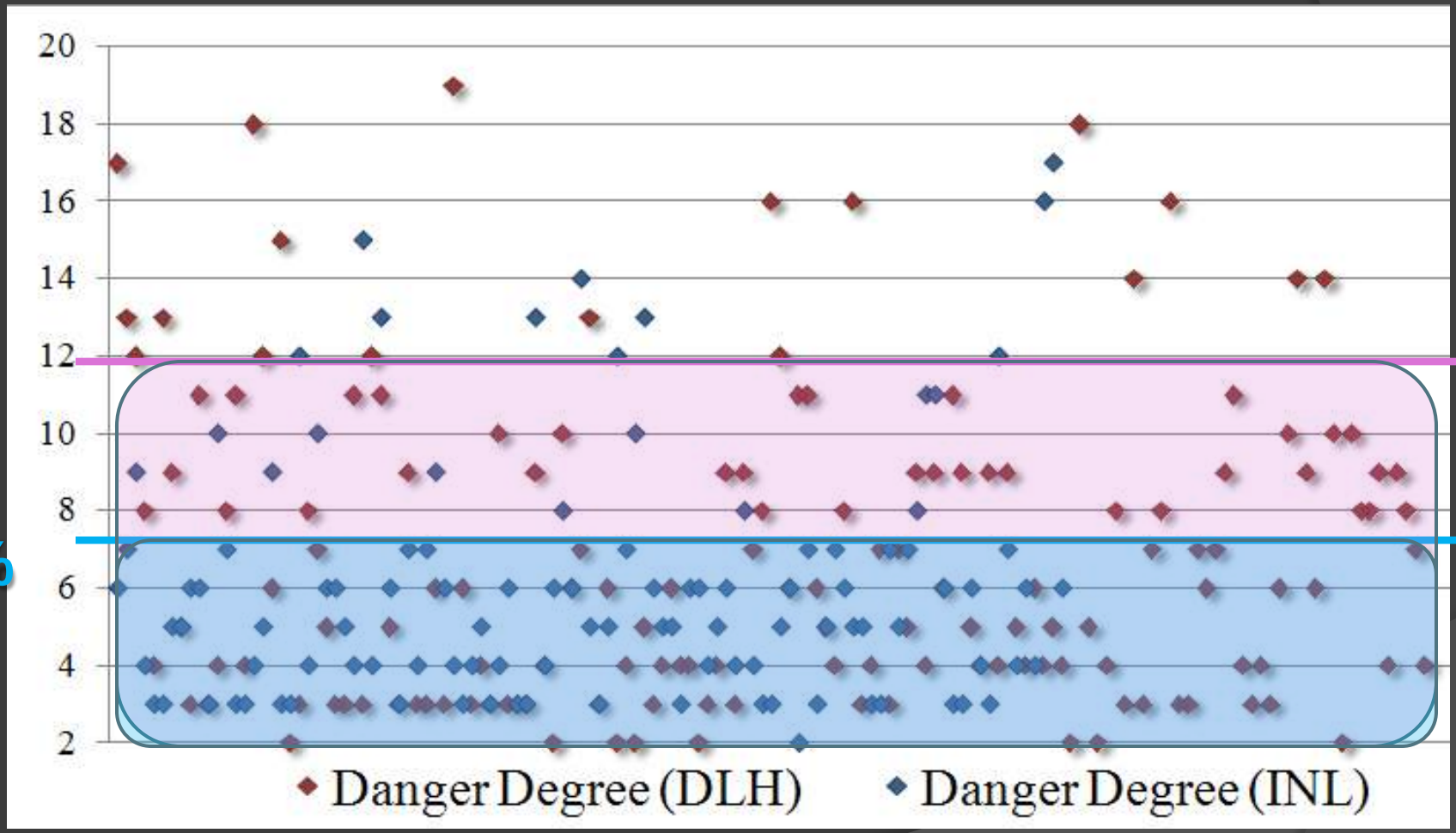


Danger Degree Project

No Headline



Danger Degree Project



Danger Degree Project

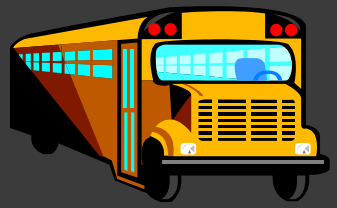
Several Warnings with Danger Degree Values < 5

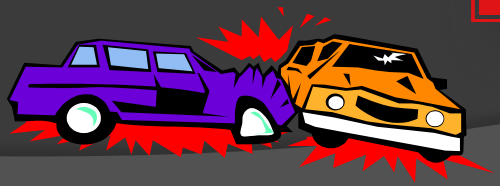
- Low potential Impact

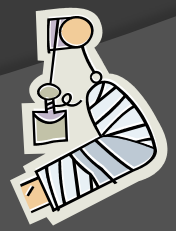
Events with Danger Degree > 14 with No Headline

- High Potential Impact

What was the Impact?







Danger Degree Project

Can We measure our Success?

Current Assumption

↑ Danger Degree = ↑ Impact

Ultimate Goal

↑ Danger Degree = ↓ Impact

Danger Degree Project

What's Next?

Stakeholder Impact Reporting Following an Event

- MN/WI AAA
- Red Cross
- Wisconsin/Minnesota DOTs
- MN Power/Lakes Power
- School Superintendents
- Hospital Administrators
- City Officials
- Local Businesses

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Thank You

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